Creating COASTAL STEWARDSHIP through Science

Observing Pacific Gray Whales

Pre-Visit Activities

How Can I Learn About the Lives of Pacific Gray Whales?

After reading a newspaper on gray whale ecology, students complete a series of activity sheets focusing on migration, relationship to other mammals, and human interventions. This activity will form the foundation for all other activities, including the on-site visit.

Time required: 2 hours

Location: classroom/ homework

Suggested group size: entire class

Subject(s): science, biology, mathematics, creative writing

Concept(s) covered: population dymanics, human ecology, life cycles, biology, ethics

Written by: Christie Denzel Anastasia, National Park Service

Last updated: 11/27/00

Student Outcomes

At the end of this activity, the students will be able to:

- Complete activity sheets based on their comprehension of the *Pacific Gray Whale* Newspaper.
- Understand how natural and human activities relate to gray whale populations.
- Understand the role and importance of students and Point Reyes National Seashore in conserving Pacific gray whales.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade
- 5a- food webs
- 5b- organisms and the physical environment
- 5e- resources available and abiotic factors
- 7b- appropriate tools and technology to perform tests, collect data, and display data
- 7c- develop qualitative statements about the relationships between variables

7th grade	2a- differences between the life cycles and reproduction of sexual and asexual organisms 3e- extinction of a species occurs when the environment changes and the adaptive characteristics for a species are insufficient for its survival 5a- animals have levels of organization for structure and function 5d- reproduction 7a- appropriate tools and technology to perform tests, collect data, and display data 7d- construct scale models and appropriately labeled diagrams to communicate scientific knowledge
8th grade	9b- evaluate the accuracy and reproducibility of data.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Think critically and logically to make the relationship between evidence and explanations; use mathematics in all aspects of scientific inquiry.
- Content Standard C - Structure and function in living systems; Reproduction and heredity; Regulation and behavior; Populations and ecosystems; Diversity and adaptations of organisms.
- Content Standard F - Science and technology in society

Materials

To be photocopied from this guide:

- **Pre- and Post- Evaluation** Activity Sheet
- *Pacific Gray Whale* Newspaper
- **Vocabulary** sheets located in Teacher's Preparation/ Attachments
- **Migration-What, Why, Who** Activity Sheet
- **Like and Unalike** Activity Sheet
- **Annual Behaviors** Activity Sheet
- **What's it Like to be a Gray Whale?** Activity Sheet
- **Technology, Intervention, Ethics** Activity Sheet
- **Whaling Computations** Activity Sheet

Vocabulary

amphipod, baleen, blubber, dorsal ridge, estuary, fluke, invertebrate, krill, lagoon, migration, niche, pectoral flippers, rostrum

Procedures

1. Pre- and Post- Evaluation

Distribute **Pre- and Post- Evaluation** activity sheets. Remind students this is not a graded test, but rather a measure of our success; each student will retake the same test after several lessons. (Note: You may choose to save these completed tests and redistribute in the first postvisit lesson. Students change their answers based on what they have learned.)

2. Distribute Newspaper

Students receive and read Pacific Gray Whale Newspaper. Students can work in pairs or individually to complete activities.

3. Reading comprehension

Read the *Pacific Gray Whale* newspaper as a class and clarify any questions or comments from students.

4. Activity sheets

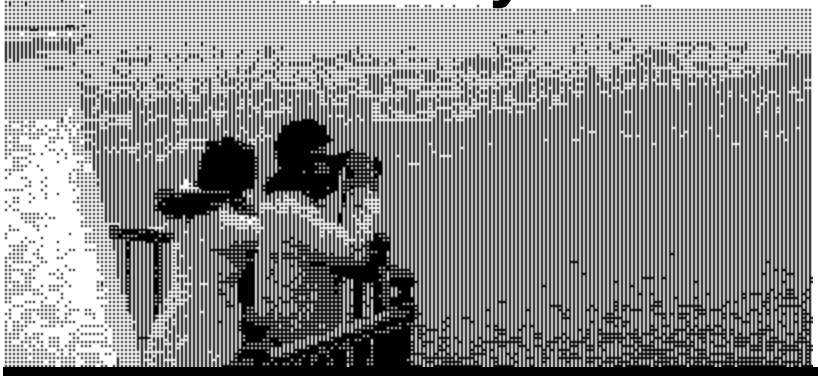
Give each student appropriate activity sheets, vocabulary list, and instructions for completion.

5. Conclusions

Review students' answers, exchange ideas, and relate these concepts to lessons already covered earlier in the year.

Pacific Gray Whales

Point Reyes National Seashore



Inside:

Passing by Point Reyes

Thousands of people come to Point Reyes National Seashore every year to look for gray whales. They awaken in us a sense of awe and wonder with their size and grace, and with their stunning life habits that are so different from ours.

A few decades ago, the delicate plume of a spout rising into the air and then slowly fading would have been a rare sight for whale watchers. Hunting had devastated the Pacific gray whale population and put them in danger of extinction. As a result of international and national protection, we can glimpse the gray whales once again as they travel on their annual migratory path.

Pacific gray whale migration route

Many whale species are visible from the the shore of Point Reyes, but the most common is the Pacific gray whale. Each year in January, gray whales pass by the Point Reyes Headlands as they migrate southward from their summer feeding grounds in the arctic Bering and Chukchi Seas to the warm calving lagoons of Baja California. In late March and early April, they pass by the Headlands on their northward return to their feeding grounds. We humans might find a commute of 50 miles much too long, but these whales make an annual round-trip journey of 10,000 miles and travel for almost 2 months each way!

Whales are completely at home in an environment that to us can be harsh and deadly. They dive to depths that would crush us and live itemperatures that would rapidly drain our warmth and life.

They are mammals, like us, and must breathe air to live, but they spend little time above water. They surface, exhale, and take a breath before they disappear back into the dark waters. The spout, a heart-shaped plume of mist, is like your breath on a cold morning, but much, much larger. It seems so thin and wispy from afar, but if you could stand on the back of a gray whale, you would see the spout whoosh up into the air some 10 to 15 feet.

Whales are the ambassadors of the incredible undersea world. They tell us about their lives and their world, but if we listen, they will also tell us about ourselves. They sing to us about the best and the worst of human nature and our own hope for the future.

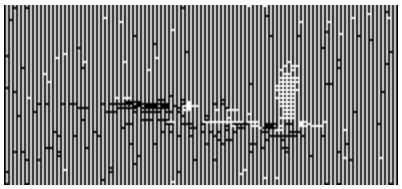
Since they were first seen, whales have most likely been viewed with the same sense of wonder we have today. However, 100 years ago (and more) whales were a commodity to be hunted and sold. The oil and baleen of thousands of whales produced a livelihood for hundreds of people. Wavering at the edge of extinction, many whale species nearly disappeared forever. Today, they are viewed as a natural gift to be treasured.

People made the choice to save the whales. Individuals spoke out to protect the whales that remained. Governments listened, and eventually passed laws that gave protection to these magnificent animals. And the whales recovered.

The world is an incredible place, infinitely and intricately interconnected, full of mysteries we are only slowly unraveling. Whales provide us with a connection to some of those mysteries. They are symbols of the resilience of nature and of the idea that it is not too late to make the world a better place. They symbolize our hope in the future. In today's world, it is important to know that each of us can make a difference. Maybe that is why people love to watch for whales.

Whale Adaptations

Gray whales are not the largest, fastest or deepest diving whale, but they are marvelous animals that have adapted to a life at sea. Gray whales have taken advantage of niches in the marine environment that other whales are unable to use.



During the northern migration, gray whale cows and their calves often swim so close to the shoreline that lighthouse whale watchers can hear them breathing.

Gray whales are an illustration of millions of years of adaptation. Fifty million years ago, mesoncychids, a primitive relative of the deer and the ancient ancestor of the whale, left the land in search of food. As their descendants adapted to living in the water, they became some of the most highly specialized creatures of all time. Gray whales share many of the adaptations that make whales in general so successful and have a few that make them unique.

SEAGOING MAMMALS

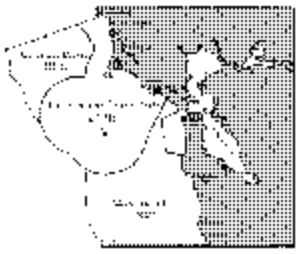
The body of the whale has adapted to make it more efficient in the water. The tail grew large muscles and developed flukes to gain more power for swimming. The forelegs developed into pectoral flippers that help it to maneuver and the hind legs slowly disappeared. Today, the only vestiges of those hind legs are small bones hidden inside the whale's body. The nostrils, or blowholes, moved to the top of the head to make breathing while swimming easier. The rostrum and the top of the head took on a shape that helps to direct the water around the blowhole so as not to flood the whale as it breathes. Unlike humans, whale's lungs and mouths are not connected. A whale can both breathe and feed at the surface, all without drowning. Like humans, gray whales are mammals. They are warm-blooded, give birth to live young, and have hair. Pacific gray whales give birth to their calves in the protected, warm bays and estuaries of Baja California. Most birthing occurs in January and February. At birth, a single calf weighs up to 2,000 pounds and is 15 feet long. The calf nurses from mammary glands tucked inside narrow slits on the belly of the female. The rich milk is about 40% fat and is the consistency of cottage cheese or margarine. After several months of consuming more than 50 gallons per day, the calf is 26-30 feet long and nearly double its original weight when finally weaned.

We all love the ocean's surface with its beautiful sparkle blue. But beneath it, down deeper, whales are moving with slow, drifting currents - whales that are great, gentle, cloudlike beings.

Roger Payne,

MIGRATION

The life of the gray whale includes a migration that ranks as one of the longest of any species of mammal. Migration is a behavioral adaptation that allows animals to take advantage of rich resources that may be available only at certain times in the year. Most gray whales migrate every spring from their birthing and breeding lagoons in Baja California to the shallow, muddy waters of the Bering Sea. This 5,000 mile journey takes over 55 days. They follow the coastal contours as they migrate, but are also thought to navigate by magnetic pathways. They often will avoid areas with heavy ship traffic or cloudy waters, such as the sediment-filled plume of San Francisco Bay. Not all gray whales make the full return journey to the northern waters of the Bering Sea. Some will linger along the migratory route or even summer at other locations. In recent years, small numbers of gray whales have summered in Tomales Bay and near the Farallon Islands. They can find food in Drakes Bay and Tomales Bay, where they are occasionally seen feeding just beyond the surf.



The National Oceanic and Atmospheric Administration (NOAA) provides additional protection to the ocean waters around Point Reyes National Seashore. The Cordell Bank, Gulf of the Farallones, and Monterey Bay National Marine Sactuaries protect over 7,100 square miles of California's marine habitat. Winds, waves and ocean currents converge along the continental shelf that stretches within these sanctuaries, creating a resource-rich environment. This habitat is essential to whales and other species, including humans.

Spotting Pacific Gray Whales at Point Reyes

Gray whales can be seen from January to early May.

The peak of the migration south to Baja, CA is in January.

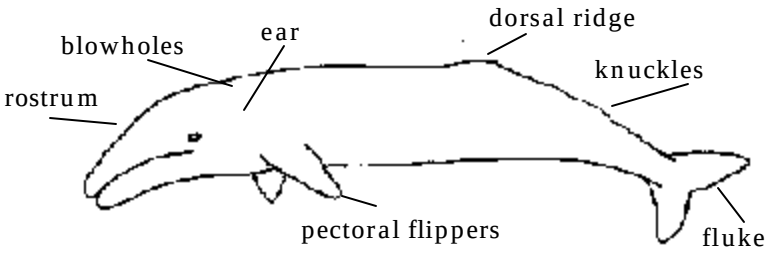
The peak of the migration north is in March.

Poor visibility and high wind speeds can greatly reduce sightings.

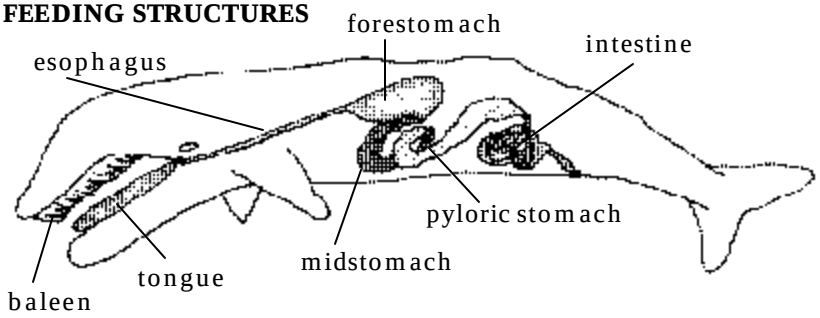
Evolution and Anatomy

When spotting gray whales, look for the external anatomy which can be easily seen. Locating a gray whale's blowholes is easy as soon as you see one spout. The spout is often the first thing that you will see but it is not the last. As the whale surfaces to breathe, its rostrum, back, dorsal ridge and knuckles come into view. When it sounds, you can often see the tail fluke. Keep your eyes open, sometimes a whale will breach and a full view of the external anatomy will be seen in all its splendor!

EXTERNAL ANATOMY



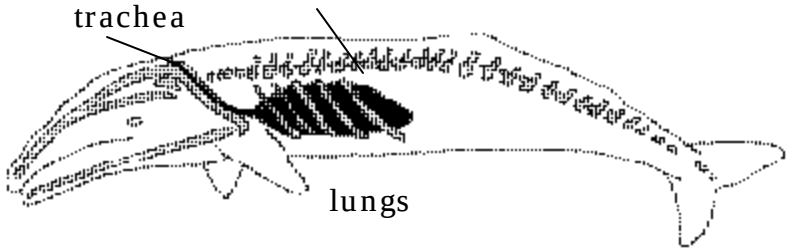
FEEDING STRUCTURES

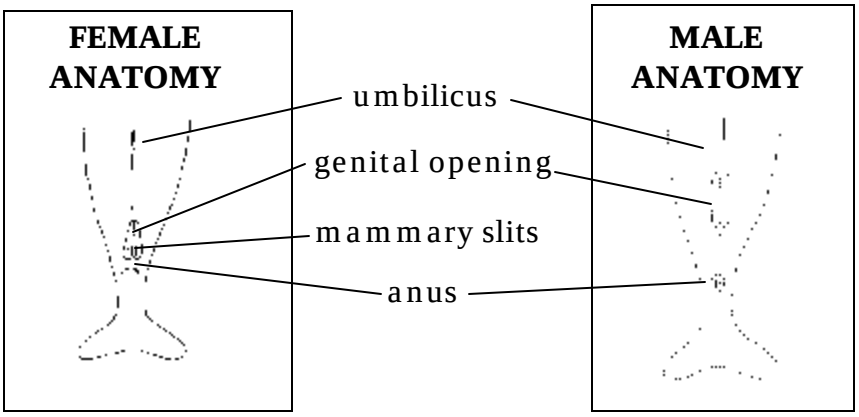


If you were an amphipod scooped up from the ocean floor by a gray whale, you would be in for an exciting ride. As the whale's tongue forced you against the baleen you would be separated from the mud and water that surrounded you. Then you would feel the mouth sweeping you toward the back of the throat to be swallowed. How much you would feel after that point could be debated. As a human however, there's not to much to worry about. The opening to the esophagus is much too small to accommodate anything of our size.

As a gray whale you would never have to worry about having your food go down your windpipe. That's because a gray whale's mouth and lungs are not connected. The lungs of a gray whale and all other whales are connected only to the blowholes, not to the mouth. If we had evolved similarly, we would be able to drink and breathe at the same time. This is not something that would concern a whale, however, because they never drink. Whales get all their water from the food they eat. If this is true, why would they have evolved in such a manner?

BREATHING STRUCTURES





Adapting to life in the ocean has brought many changes to the gray whales' anatomy, yet they are distinctly mammals. In that regard, we are not so different. We are both warm-blooded, nurse our young from mammary glands, have some hair and breathe air. We also have an umbilicus or "belly button". These common traits are shared by all mammals regardless of whether they swim in the ocean waters, walk on land, or fly in the skies. These traits also set us apart from birds, reptiles, amphibians and other types of life.

Filling a Niche

SHALLOW FEEDERS

Gray whales migrate and forage along the continental shelf and have adapted to diving in shallow water. Typically, they stay in waters approximately 30 fathoms (180 feet) deep. Most whales feed at the surface of the open ocean, using their baleen to filter the water for krill and small fish. Gray whales have adapted to a special niche that other whales don't feed in. Gray whales literally suck mud up from the bottom of the Bering and

Amphipod

Chuckchi Seas feeding on the invertebrates that inhabit the top few inches of mud. Gray whales mostly eat shrimp like amphipods, but also eat surface-dwelling swarms of krill and, sometimes, small schooling fish.

A Pacific gray whale feeds by swimming slowly above the surface of the muddy bottom, at depths of up to 200 feet. Rolling over on its side, it opens its mouth slightly, and retracts its tongue (which weighs around 2,500 pounds). This action forms a powerful suction that enables the whale to suck up the food-filled mud. The tongue then forces it through the baleen on the opposite side of the whale's mouth. Working as a filter, the baleen traps the invertebrates and then the tongue maneuvers the food for swallowing. “Right-handed" whales feed by tilting onto their right side. Some prefer to feed on their left - you can tell by the absence of barnacles on the side of the head that is rubbed against the ocean bottom. During each summer, gray whales can consume around 65 tons of food, gaining up to 30% in weight.

Much of the energy from this feeding is saved for the future. The food energy is stored as a thick layer of fat, or blubber. Blubber is an adaptation common among many marine mammals. It helps to insulate the whale in cold waters and provides a stored energy reserve for the rest of the year. While gray whales typically don't feed much after they leave the northern feeding grounds, they probably take advantage of food sources if they find them.

The presence of orcas and white sharks in the waters surrounding Point Reyes may force gray whales to travel very close to the shorelines as they travel north with their calv

IMPORTANT PART OF THE ECOYSTEM

Gray whales are an important part of the food web and play a large role in the success of their feeding-ground ecosystems. As they plow the bottom of the Bering Sea, one gray whale can dredge 100 acres of mud per summer. Their foraging behavior releases sediments upward into the water column. This provides a significant source of nutrients for other organisms in the coastal ecosystem. Furthermore, the deep depressions left by their plowing creates habitat for many of the organisms that colonize the ocean floor, or benthic zone. Among these organisms are the very amphipods the whales feed on.

Other species of animals have adapted to, and depend on, the presence of the whales. Orcas are one of the major predators of gray whales. The fins of many gray whales show the scars of their encounters with these predators. White sharks may prey on calves, but probably don't attack adult whales. Smaller creatures make their home on the grays. Several species of whale lice, amphipods related to the food of the gray whale, crawl about feeding on the skin of the whale. Several different

Whale lice

species of barnacles can be found on gray whales.

Whole colonies attach themselves to the whale's skin and live their entire lives there.

At Point Reyes, we watch the whales as they migrate past, but only glimpse a small part of their complex lives. Over thousands, if not millions, of years the whales have adapted to their environment, even as they have helped to shape it. Sometimes it is difficult to see the whales and appreciate the great changes and forces that have influenced their very lives. Like so many things in the world around us, each piece of the environment is interconnected and influences the other. Perhaps we should stop and ask ourselves where we fit into the lives of the whales.

For More Information

Point Reyes National Seashore
Point Reyes Station, CA 94956
www.nps.gov/pore

Gulf of the Farallones
National Marine Sanctuary
GGNRA, Fort Mason
San Francisco, CA 94123
www.farallones.org

American Cetacean Society
P.O. Box 2639
San Pedro, CA 90731-0943
http://www.acs-la.org

Marine MammalCenter
MarinHeadlands, GGNRA
Sausalito, CA 94965
www.tmmc.org

Humans and Gray Whales

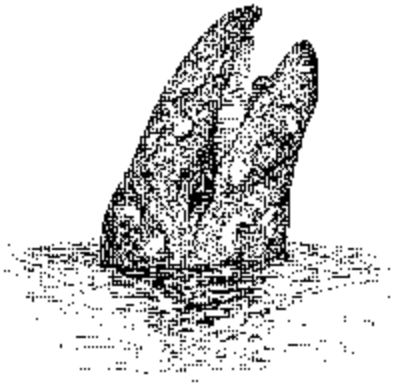
Our fascination with whales has had a huge impact on all species of whales world wide. Human demands have pushed many whale populations to the edge of extinction, or beyond, and human convictions have brought many of them back.

Using hand-held spears and small boats, Native Americans of Alaska and the Pacific Northwest hunted gray whales for food. Europeans used whale baleen in making hoopskirts, corsets, and buggy whips, and found whale blubber to be a valuable source of oil for lanterns and factory machinery. The growing industrial nations demanded this oil in huge amounts. At first, gray whales were not a popular target for many whalers. Their oil was of poor quality and their baleen was too coarse to bring much profit. Right and bowhead whales were preferred, but as those declined in number, the price of oil soared. Even if less valuable, an adult gray whale could produce up to 25 barrels of oil that sold for as much as $45 a barrel. Shore whaling stations sprang up along the migration route on the California coastline. New technology made whaling more efficient. Explosive harpoons, known as "bomb lances," were invented in 1865. By 1874, a whaling captain and early naturalist wrote:

"the mammoth bones of the California Gray Whale lie bleaching on the shores of those silvery waters and scattered along the broken coasts, from Siberia to the Gulf of California; and ere long it may be questioned whether this mammal will not be numbered among the extinct species of the Pacific."
-Captain Charles Scammon

As gray whales vanished, the shore stations closed. But in 1914, fast, new steam-powered whaling ships with harpoon- firing cannons made escape all but impossible. While electricity and petroleum products replaced whale oil in lanterns and machines, their oil was still used to make soap and their meat used in fertilizers and pet food. It has been estimated that as few as 1,000 Pacific gray whales were left alive in the 1930s.

Even the whalers realized that extinction seemed imminent. A ban on hunting gray whales was implemented in 1937. In 1946, an international agreement to ban commercial whaling was signed by most of the whaling



nations. Subsistence hunting still continues in some cultures and commercial whaling still continues in Japan, Finland, and Iceland.

Many people have learned to value whales beyond their monetary worth. The grandeur of whales has captured the hearts of people around the world. In the 1960s and '70s, many adults and school children wrote letters to Congress, expressing their concern for the protection of the environment and especially for the whales. Laws, like the Marine Mammal Protection Act, were created to help preserve whales and other marine mammals. These efforts led to the recovery of the gray whale population. Today there are an estimated 25,000 to 27,000 gray whales, perhaps nearing the number that existed before commercial whaling. Whale watching has replaced whaling as a profitable industry. Although gray whales are protected, there are still risks for them. Whales, and other sea mammals and birds, get caught in gill nets used for fishing. Unable to reach the surface to breathe, they drown. Whales are susceptible to pollution dumped into the oceans, and some have scars that show the danger of collisions with ships. New studies also indicate that noise pollution from ships and industry may cause harm to the whales' hearing and ability to navigate.

Gray whales have provided food, supplied power and wealth for growing nations, and have become a respected symbol of the ocean environment. More importantly, they symbolize how much impact our choices and decisions can have on the world around us - each of us can make the world a better place.

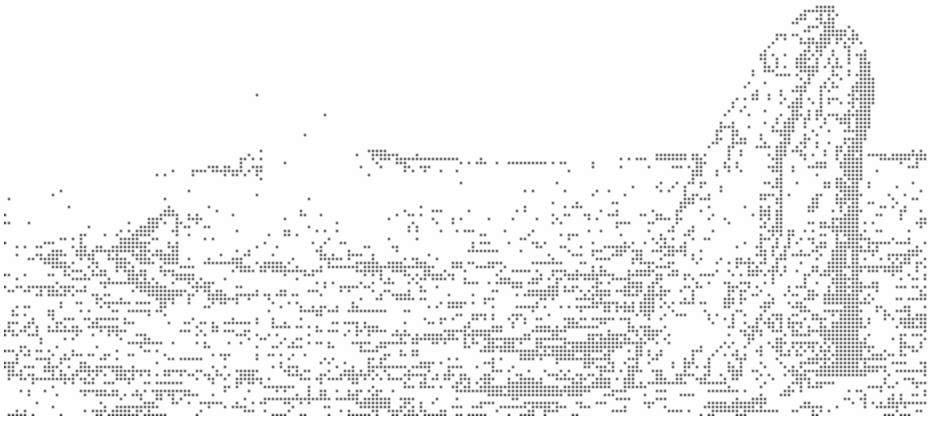
"We are the only species which, when it chooses to do so, will go to great effort to save what it might destroy."

Wallace Stegner

Humans and Gray Whales

Speculative Estimates of Historic Gray Whale Populations

Human Actions	Year	Gray Whale Populations
Traditional hunting for food	before 1800's	
Shore whaling starts in California	1854	
Discovery of Baja lagoons	1855	
Petroleum first used for fuel	1859	
Bomb lance invented	1865	
Whales find few gray whales	1875	
Native Siberian whalers starve	1880's	
Shore whaling in California dies out	1880-1900	
Spring steel replaces baleen in corsets	1909	
Steam-powered whaling ships start hunting gray whales	1914	
Factory ships process whales quickly at sea	1920's-30's	
Whalers ban hunting grays	1936	
International Ban on whaling	1947	
Marine Mammal Protection Act	1972	
Endangered Species Act (1973)		
Grays removed from Endangered Species List	1955	
Proposed and vetoed salt refining in Baja	2000	



Special Thanks

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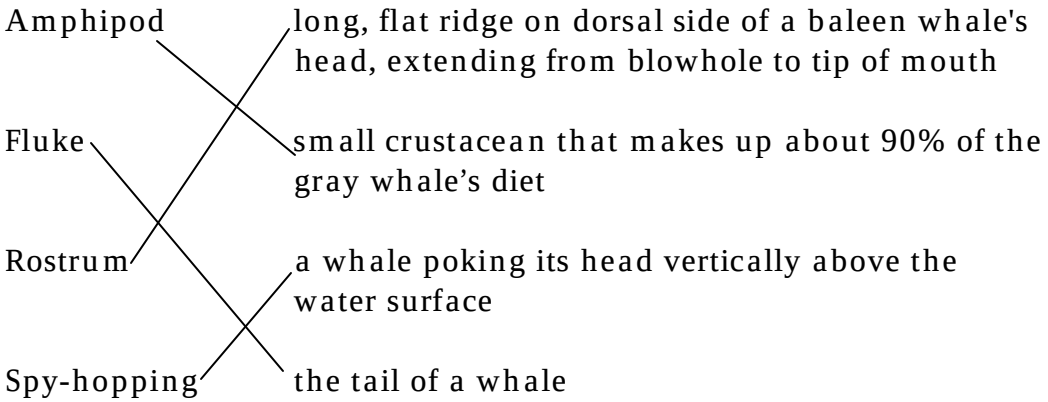
Design/Layout: John Golda
Artwork: David Willard and
Christie Denzel Anastasia
Managing Editor/Writer: John Golda

Pre- and Post- Evaluation

Activity Master

Vocabulary Match-Up

Draw connecting lines between words and their definitions.



Increase or Decrease

Place the following list of words in the appropriate column according to whether it increased or decreased the populations of gray whales: *discovery of breeding lagoons, international ban on whaling, bomb lance invented, Marine Mammal Protection Act, steam-powered hunting ships, Endangered Species Act, whalers ban hunting grays, factory ships process whales at sea.*

Increases gray whale populations	Decreases gray whale populations
international ban on whaling	***bomb lance invented***
Endangered Species Act	***factory ships process whales at sea***
whalers ban hunting grays	***steam-powered hunting ships***
Marine Mammal Protection Act	***discovery of breeding lagoons***

National Park System

Which part of the National Park System is closest to where you live?

Point Reyes National Seashore,
Golden Gate National Recreation Area, Muir Woods National Monument

True or False?

T/(F) gray whales are listed as an endangered species
T/(F) gray whales pass by Point Reyes four times a year.
(T)/F gray whales make a round-trip journey of 10,000 miles

Stewardship

What can you do to provide a clean ocean habitat and safe passage for gray whales? List your ideas on the back of this paper. ***answers will vary***

Name _____ **Date** _____

Activity Sheet

Pre- and Post- Evaluation

Vocabulary Match-Up

Draw connecting lines between words and their definitions.

Amphipod	long, flat ridge on dorsal side of a baleen whale's head, extending from blowhole to tip of mouth
Fluke	small crustacean that makes up about 90% of the gray whale's diet
Rostrum	a whale poking its head vertically above the water surface
Spy-hopping	the tail of a whale

Increase or Decrease

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Increases gray whale populations	Decreases gray whale populations

National Park System

Which part of the National Park System is closest to where you live?

True or False?

T/F gray whales are listed as an endangered species
T/F gray whales pass by Point Reyes four times a year.
T/F gray whales make a round-trip journey of 10,000 miles

Stewardship

What can you do to provide a clean ocean habitat and safe passage for gray whales? List your ideas on the back of this paper.

Pacific Gray Whale Newspaper Activity

Migration- What, Why, Who

WHAT Is Migration?

Locate a definition of migration:

seasonal movement from one region to another

WHY Migrate?

Brainstorm all the reasons WHY animals migrate:

better food, better climate, reproduction, poor habitat

WHO Migrates?

Starting with the gray whale, list all the animals you can think of that migrate. Next, list their migration route and why they migrate:

Animal	Migration Route	Reason for Migration
gray whales	***Bering Sea to Baja California***	***breeding, food***
Rocky Mountain elk	***high elevation to low elevation***	***change of season, food***
northern elephant seals	***Pacific coast***	***food, breeding***
Monarch butterflies	***Canada/ Northern U.S. to Mexico***	***escape the cold?***
humans	***varies***	***war, relocation, herding***
birds	***varies***	***better climate, food, reproduction***

Pacific Gray Whale Newspaper Activity

Like and Unalike

Use the newspaper and your own ideas to brainstorm the following:

In what ways are gray whales like other mammals?	***breathe air*** ***warm-blooded*** ***nurse their young from mammary glands*** ***live birth***
How are gray whales different from other mammals?	***eat plankton*** ***specialized for life in ocean, spend most of their lives underwater*** ***fluke/flipper*** ***do not have a coat of hair for warmth*** ***hindlimbs completely lost (externally)***
In what ways are gray whales like other whales?	***both in order Cetacea*** ***all whales have fins, blowholes*** ***thick layer of blubber***
How are gray whales different from other whales?	***some whales toothed with one blowhole (Odonteceti)*** ***some whales have baleen and two blowholes (Mysticeti)***

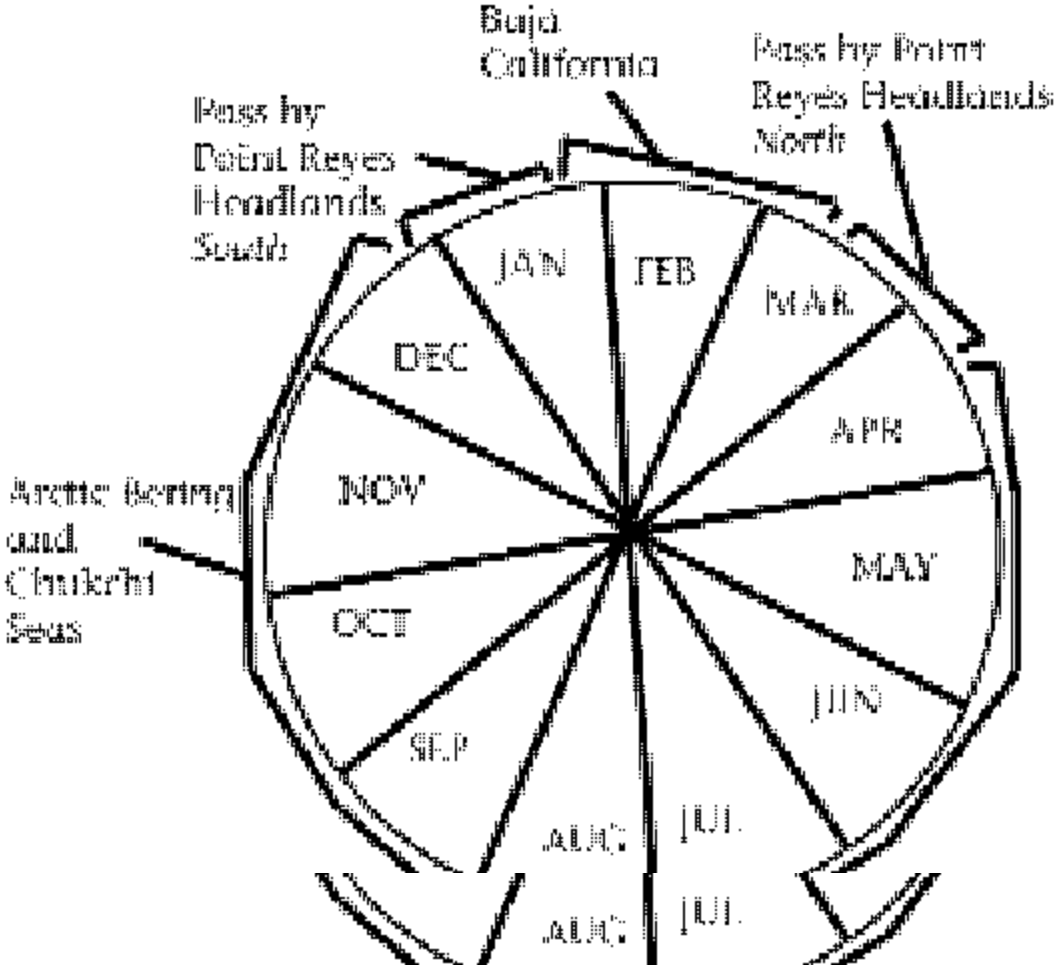
Annual Behaviors

1.Reread the *Pacific Gray Whale* newspaper. Use a blank piece of paper to record any information relevant to the Gray whale's lifestyle and what time of the year it occurs.

Be sure to include:

- Northern and southern Migration
- Breeding
- Pregnant females arrive at Baja lagoons
- Females give birth
- Seen at Point Reyes National Seashore (twice in a year)
- Arrival at feeding grounds
- Behavior at feeding grounds

2. Use the circle graph below to visually portray a gray whale's lifecycle over the course of a year. Colors and different styles of writing will help organize the information.



Pacific Gray Whale Newspaper Activity

What is It Like To Be a Gray Whale?

Imagine and write a story in the first person describing your life as a gray whale. Use some of the following ideas to get started:

Who are you traveling with?
Are you a male, female, or calf?
Are you pregnant? Does this affect your trip?
How do you know where to go?
What does the ocean floor look like?
Can you taste the differences in the water?
Do you see or hear humans or other animals or fish?
What is the difference in water temperature between the northernmost point of your route and the southernmost point? How does that feel?
What is the return trip like, after not eating much for five months?
Are you travelling with a new calf?
Is this your first baby? What is it like?
Are you hungry when you get back north?
There is much that humans don't know about whales. What would you like to tell them?

essays will vary

Pacific Gray Whale Newspaper Activity

Technology, Intervention, Ethics

Whale populations have been hunted for food and raw materials for hundreds of years. It was not until they were hunted for profit that their population numbers were significantly affected.

1. List three technological devices that increased efficiency/profit of whaling and their consequences on the total whale population.

Technology	Consequence
a. ***bomb lance invented***	***decline***
b. ***steam-powered whaling ships***	***decline***
c. ***factory ships at sea***	***decline***

2. List three interventions that helped gray whale populations make a comeback.

Intervention	Consequence
a. ***ban on hunting gray whales***	***increase***
b. ***international ban on whaling***	***increase***
c. ***Marine Mammal Protection Act***	***increase***

3. Do whales have a value regardless of whether humans can economically earn a profit?

   answers will vary

4. What is the value of a whale to Point Reyes National Seashore?

   answers will vary

5. What is the value of a whale to the National Park System?

   answers will vary

6. What is the value of a whale to you?

   answers will vary

Whaling Computations

In 1843 a whaling ship returns to harbor after three years, with the following:

520 barrels of Sperm Whale Oil
1,750 barrels of Whale Oil

1843 prices of whaling ship cargo:

$1.25/gallon Sperm Whale Oil
$ .43/gallon Whale Oil

If one barrel of oil holds 32 gallons

1) How many gallons of sperm whale oil and whale oil were brought ashore?

520 x 32 = 16,640 gallons of Sperm Whale Oil
1,750 x 32 = 56,000 gallons of Whale Oil

16,640 + 56,000 = 72,640 total gallons of oil brought ashore

2) How much money was earned from this trip?

520 x 32 = 16,640 gallons of Sperm Whale Oil
1,750 x 32 = 56,000 gallons of Whale Oil

16,640 + 56,000 = 72,640 total gallons of oil brought ashore

3) If one dollar in 1843 is worth $25 today, what would be the value of the ship's cargo today?

$44,880 x $25 = $1,122,000 value today

4) What was the yearly income of this ships cargo in today's dollar value?

$1,122,000/ 3 = $374,000 yearly income

Name _____ **Date** _____

Activity Sheet

Pacific Gray Whale Newspaper Activity

Migration- What, Why, Who

WHAT Is Migration?

Locate a definition of migration:

WHY Migrate?

Brainstorm all the reasons WHY animals migrate:

WHO Migrates?

Starting with the gray whale, list all the animals you can think of that migrate. Next, list their migration route and why they migrate:

Animal	Migration Route	Reason for Migration

Name _____ **Date** _____

Activity Sheet

Pacific Gray Whale Newspaper Activity

Like and Unalike

Use the newspaper and your own ideas to brainstorm the following:

In what ways are gray whales like other mammals?	
How are gray whales different from other mammals?	
In what ways are gray whales like other whales?	
How are gray whales different from other whales?	

Name _____ **Date** _____

Activity Sheet

Pacific Gray Whale Newspaper Activity

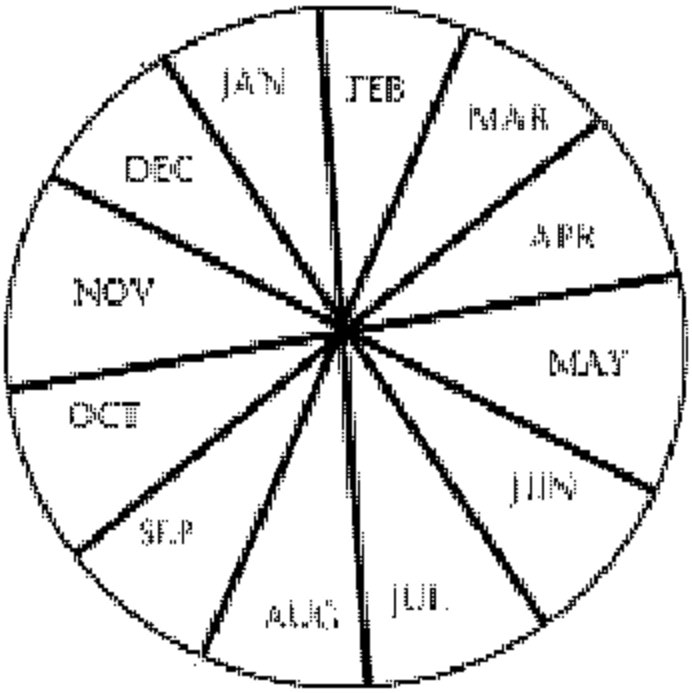
Annual Behaviors

1.Reread the *Pacific Gray Whale* newspaper. Use a blank piece of paper to record any information relevant to the gray whale's lifestyle and what time of the year it occurs.

Be sure to include:

- Northern and southern Migration
- Breeding
- Pregnant females arrive at Baja lagoons
- Females give birth
- Seen at Point Reyes National Seashore (twice in a year)
- Arrival at feeding grounds
- Behavior at feeding grounds

2. Use the circle graph below to visually portray a gray whale's lifecycle over the course of a year. Colors and different styles of writing will help organize the information.



Name _____ **Date** _____

Activity Sheet

Pacific Gray Whale Newspaper Activity

What is It Like To Be a Gray Whale?

Imagine and write a story in the first person narrative describing your life as a Gray whale. Use some of the following ideas to get started:

Who are you traveling with?
Are you a male, female, or calf?
Are you pregnant? Does this affect your trip?
How do you know where to go?
What does the ocean floor look like?
Can you taste the differences in the water?
Do you see or hear humans or other animals or fish?
What is the difference in water temperature between the northernmost point of your route and the southernmost point? How does that feel?
What is the return trip like, after not eating much for five months?
Are you travelling with a new calf?
Is this your first baby? What is it like?
Are you hungry when you get back north?
There is much that humans don't know about whales. What would you like to tell them?

Name _____ **Date** _____

Activity Sheet

Pacific Gray Whale Newspaper Activity

Technology, Intervention, Ethics

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1. List three technological devices that increased efficiency/profit of whaling and their consequences on the total whale population.

Technology	Consequence
a.	
b.	
c.	

2. List three interventions that helped gray whale populations make a comeback.

Intervention	Consequence
a.	
b.	
c.	

3. Do whales have a value regardless of whether humans can economically earn a profit?

4. What is the value of a whale to Point Reyes National Seashore?

5. What is the value of a whale to the National Park System?

6. What is the value of a whale to you?

Name _____ **Date** _____

Activity Sheet

Pacific Gray Whale Newspaper Activity

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2) How much money was earned from this trip?

3) If one dollar in 1843 is worth $25 today, what would be the value of the ship's cargo today?

4) What was the yearly income of this ships cargo in today's dollar value?

How Have Gray Whales Adapted to Life in the Ocean?

Students explore the concept of mammals and whales becoming adapted to an ocean existence. Following a brainstorming activity, the students role-play a "Class Action Gray Whale" and relate physical features to specific adaptations for all whales.

Time required: 2 hours
Location: classroom
Suggested group size: entire class
Subject(s): science
Concept(s) covered: mammal characteristics, whale adaptations
Adapted from: A Class Action Whale
MARE Teachers Guide to the Open Ocean
Written by: Jim Corsetti, Petaluma Middle School
Last updated: 09/22/01

Student Outcomes

At the end of this activity, the students will be able to:

- Understand adaptations associated with mammals' transitioning from a land to marine existence.
- Role-play one physical part of a gray whale.

California Science Standard Links (grades 6-8)

This activity is linked to the Californian Science Standards in the following areas:

7th grade 3a-genetic variation and environmental factors are causes of evolution and diversity of organisms
5a-animals have levels of organization for structure and function

Pre-Visit Lesson Plan

Creating Coastal Stewardship through Science

Pre-Visit Lesson Plan

National Science Standard Links (grades 5-8)

This activity is linked to the National Science standards in the following areas:

- Content Standard C - Structure and Function in Living Systems, Diversity and Adaptations of Organisms, Reproduction and Heredity

Materials

To be provided by the teacher:

- Optional: 15-20 magazine pictures of various land mammals

To be photocopied from this guide:

- **What Is a Gray Whale?** Teacher Information Sheet
- **How Have Whales Adapted to Life in the Ocean?** Teacher Information

Vocabulary

dorsal ridge, fluke, pectoral flippers, peduncle, rostrum, ventral pleats

Procedures

1. Review adaptations

Introduce lesson by reviewing concepts and examples of adaptations.

2. Silent Mingle strategy

Students are instructed to mingle among other classmates without talking. When the teacher gives a predetermined signal, students stop and face the nearest student. Teacher poses first focus question and student pair discusses possible answers. After 2 minutes, the process is repeated with remaining questions. Students should not pair up with the same partner more than once.

Focus questions:

a) What are characteristics of mammals?

b) What are the strangest mammals you can think of? Why are they strange?

c) Why would it be difficult for a mountain lion to live in the ocean?

3. Think/Pair/Share

Have students share a desk with their last silent mingle partner. Pair will choose a land mammal (or a magazine photo of a mammal). The task is to decide how their particular land mammal could be adapted to successfully live in the ocean and why those adaptations are necessary. Let students jot down notes and draw pictures. Afterwards, students share ideas with class. Eventually, there will be a class brainstorm. List all of the ideas students came up with for adaptations and why adaptations are necessary.

4. Gray whale adaptations

Lead students in a discussion to brainstorm whale specific adaptations to an ocean life. Use the Teacher Information Sheet **How Have Whales Adapted to Life in the Ocean?** for additional ideas.

5. A "Class Action Gray Whale"

Let the students know they are about to become a Pacific gray whale. Allow plenty of space for students to become various parts of the whale, one part at a time. Use the Teacher Information Sheet **What Is a Gray Whale?** as guidance for instructions to give students. Also refer to the Teacher Information Sheet **How Have Whales Adapted to Life in the Ocean?** for brainstorming adaptations for each specific part of the whale as it is assembled. Use the section in the *Pacific Gray Whale* Newspaper for specifics on gray whale anatomy.

Extension ideas

1. Bring a bucket of sidewalk chalk to the playground and have students draw life-size whale and label anatomical parts. This could also be done on the blackboard with explanations of body parts provided by the student.

What Is a Gray Whale?

Rostrum: Two students

These students stand facing each other 2-3 feet apart. Their right arms are extended frontward and to the left. Their right hands are joined to make a point. Their heads should be lowered to shoulder level to be streamlined. They are now the large, flat upper jaw or rostrum.

Lower Jaw: Two students

Each student kneels next to the right hip of each half of the rostrum. Students extend their right arms so that their right hands meet under the rostrum. If they curve their arms, the lower jaw will be wider. Have students practice opening and closing the whale's mouth by raising and lowering their arms together. Only the lower jaw moves, the rostrum stays stationary.

Blowholes and Blow: Six students

Two students will represent a blowhole and one student the breath. With two blowholes, two trios working as a team will accomplish this function. Each "blowhole" will stand a few feet behind the mouth with their hands high and close together. Two "breaths" will stand under their respective blowhole. When the whale is underwater, the “breath” is crouched and the “blowholes” have themselves closed. When the whale surfaces, the “blowholes” open, making loud breathing noises, and the "breath" can jump up and yell "Thar she blows"." Practice a series of four to five blows.

Eyes: Two students

Each student stands facing out on each side of the mouth just behind the blowhole. The eyes will stick out quite a ways from the side of the whale's head. These eyes can help locate food.

Pectoral Flipper: Four students

Two students stand side by side, angling back from just behind the eyes on each side of the whale. They can hold their arms up and join hands. Their job is to balance the whale as it swims forward or tries to steer. The left flipper goes down for a left turn and the right flipper goes up. Right flipper down for a right turn and left flipper up. Have students practice left and right turning motions.

Dorsal Ridge: One student

This student will stand behind flippers. When the whale is surfacing and breathing, student should arch back "out of water."

Teacher Information

Peduncle: Two students

These students will sit on the ground on either side of the dorsal ridge. Have their legs extend out toward where the fluke will eventually be located. The peduncle is the strongest group of muscles in the animal kingdom. It is responsible for providing power for locomotion.

Fluke: Two students

These students sit on either side of the spine, on the ground, with their feet touching the feet of the peduncles. When the peduncles push their feet forward, the tail should be on a downstroke. The fluke lies down. When the peducles pull their feet back, the fluke sits up. This requires coordination with the peduncles and fluke working as a team. Allow some time to practice until it can be done smoothly.

Crustaceans, Copepods, Benthic Invertebrates: Remaining students

These students will swarm in front of the whale or hunker down low on the sea floor. Have the whale open its mouth and practice filter-feeding.

Putting the whole whale together:

Call out behaviors to get your whale working. Filter feeding in arctic waters; migration with flippers balancing; fluke moving up and down.

How Have Whales Adapted to Life in the Ocean?

Rostrum

Body and rostrum (upper jaw) have becomes long, flat, and streamlined to move more efficiently through the water.

Blowhole

Whales still retain the ability to breathe air. Their nostrils migrated to the top of their head in order to facilitate breathing. During diving the pressure of the water operates in such a way as to close the nostrils from the outside so that regardless of the depth, there can be no leak. These nostrils connect directly to the lungs (in humans, nostrils also connect to the trachea for food passage.) This allows whales to eat without the complication of flooding the lungs.

Eyes

Eyes have become less important over time and whales have no stereoscopic vision.

Pectoral Flippers

Pectoral flippers are modified front legs, used by the whale like wings to dive and steer its way through water and for courtship and mating. The digits on the flippers have become long and covered with skin to serve as paddles. Back legs have disappeared although there are still vestigial hind legs remaining inside the body.

Peduncle/ Fluke

Originally the fluke was a tail that widened over time. The peduncle is used to power the fluke and is the strongest group of muscles in the mammal kingdom. The fluke is driven up and down as opposed to side to side as in fish. These long muscles do the work and allow the whale to be more streamlined by not having to move side to side.

Crustaceans, Copepods, Benthic Invertebrates

Gray whales have the heaviest parasite load of all the cetaceans.

Hair

The hair on whales' bodies has disappeared, although some whiskers exist around the mouth.

Teacher Information

Baleen

Baleen allows enormous whales to eat low on the food chain, with more energy available at a low cost. Although adult whale no longer have teeth, they are still present in gray whale fetuses while developing.

Blubber

Blubber developed under the skin to serve as an insulator in cold water, protection from sharks/killer whales, and a source of stored energy.

Of What Importance are Whales and Dolphins in the Ecology of the Pacific Ocean?

Students will research various whales found in the Pacific Ocean to create a "seascape" mural depicting the oceanic habitat and ecosystem components.

Time required: 2 hours

Location: classroom

Suggested group size: entire class

Subject(s): science, biology

Concept(s) covered: niche, ecosystem, food pyramids, food chains,abiotic factors, food web

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service

Last Updated: 09/22/01

Student Outcomes

At the end of this activity, the students will be able to:

- Visually perceive major life zones in the Pacific Ocean

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade
5a- food webs
5b- organisms and the physical environment.
5c- organisms can be categorized by functions
5d- different organisms may play similar ecological roles in similar biomes.
5e- the number and types of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition.
7b- appropriate tools and technology to perform tests, collect and display data.

Pre-Visit Lesson Plan

7th grade 5a- animals have levels of organization for structure and function.
5c- how bones and muscles work together to provide a structural framework for movement

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Identify questions that can be answered through scientific investigation, use appropriate tools and techniques to gather, analyze, and interpret data, think critically and logically to make the relationships between evidence and explanations.
- Content Standard C - Structure and function in living systems, Reproduction and heredity, Regulation and behavior, Populations and ecosystems, Diversity and adaptations of organisms.
- Content Standard F -Populations, resources, and environments; Science and technology in society.

Materials

To be photocopied from this guide:

- **Cetacean Research** Activity Sheet (one per student)
- **Oceanic Energy Cycling/ Major Oceanic Life Zones** Teacher Information Sheet
- **Example of a Simplified Food Web for Pacific Ocean** Teacher Information Sheet
- **Pacific Ocean Seascape** Teacher Information Sheet

Vocabulary

amphipod, aphotic zone, benthic division, carnivore, cetacean, competition, consumer, decomposer, diatom, euphotic zone, food chain, food pyramid, food web, herbivore, neuritic province, niche, oceanic province, omnivore, pelagic division, producer, scavenger

Procedures

1. Ecology Discussion

Introduce concept of "niche". What physical and biological factors are necessary to a whale's survival? Explain that a habitat can be thought of as an organism's "address", while a "niche" is its "profession". Look over the **Cetacean Research** Activity Sheet to see if there are other terms or concepts that need to be explained.

2. Independent research

Students choose which whale species they are most interested in researching. This may be done individually, in pairs, or in teams. The list should include some of the following:

Humpback Whale
Blue Whale
Killer Whale
Finback Whale
Gray Whale
Sperm Whale
Cuvier's Beaked Whale
Baird's Beaked Whale
Orca
False Killer Whale
Sei Whale
Pilot Whale
Minke Whale
Risso's Dolphin
Pacific White-Sided Dolphin
Northern Right-Whale Dolphin
Common Dolphin
Harbor Porpoise
Dall Porpoise

3. Activity sheets

Students are responsible for several types of information in their research. They may use the **Cetacean Research** Activity Sheet to focus their findings. Each team should have visual aids (drawings, photocopies, etc.) of their cetacean and other associated organisms.

4. Construct mural

Using a large piece of paper, label primary zones and the ocean floor. Each student/group will present their findings on individual whales and tape their drawings on the large piece of paper. If there are connections between their whale and whales or organisms already displayed, string could be taped to mural during their presentation. Students should end up creating something similar to **Pacific Ocean Seascape** Teacher Information Sheet.

5. Complete and review mural

What other living (biotic) ecosystem components have not yet been accounted for? Identify and label on mural.

Phytoplankton
Zooplankton (krill, amphipods)
Benthic worms
Squid
Fish (hatchet fish, Atlantic herring, Atlantic cod)
Bacteria

What nonliving (abiotic) ecosystem components have not yet been accounted for? Identify and label on mural.

- Sunlight
- Topography/sediments/depths
- Ocean currents
- Wind
- Water/air temperature
- Tides
- Chemical salinity

Identify where niche overlap occurs (ie., competition).

Identify where specific adaptations have decreased potential competition and made their niche specialization more secure.

6. Wrap-up

Emphasize the ecology of the Pacific gray whale. This is the whale most likely to be seen on your upcoming field trip to Point Reyes National Seashore.

Extension ideas

1. Review role of raw material cycles in the ocean:
   - Decomposition
   - Nitrogen cycle
   - Water cycle
   - Oxygen cycle
   - Carbon cycle
   - Phosphorous cycle
   - Sulfur cycle
   - Upwelling
   - Sediments
2. Have students compare the stratification of ocean communities to land communities. Discuss the concept of "niche".
3. Have students recreate each species to a comparative scale. Using a list of the actual length of each species, students can designate a conversion that will apply to all species. Using posterboard or another type of large paper, students can then recreate the species using freehand or a grid duplication method. This will result in a realistic comparison of sizes. Students can recreate other means to compare whales, such as a human drawn to same scale. If there is enough room somewhere in the school, these can be displayed in a family tree organization or as a mobile.
4. Using rope, as long as the longest whale, students will mark off lengths of each species identified in this activity. Comparing the different lengths provides perspective on various species and their relation to human size.
5. Use field guides to marine mammals to compare and contrast something unique about each species.

Name _____ **Date** _____

Cetacean Research Activity Sheet

Activity Sheet

Use this sheet to focus research for your presentation.

Cetacean: _____

Ecological Role: _____

_____

_____

Feeding Strategy:

- ☐ Fasting
- ☐ Gulping
- ☐ Skimming
- ☐ Suctioning
- ☐ Seasonal variations in feeding?
- ☐ Straining
- ☐ Other

Depth of Feeding: _____feet to _____feet

Trophic Level (check all that apply):

- ☐ Producer
- ☐ Herbivore
- ☐ Consumer
- ☐ Carnivore
- ☐ Decomposer
- ☐ Omnivore
- ☐ Scavenger
- ☐ Other

Food Chain:

Preys on _____

Is preyed on by _____

Is in competition with _____

Food Pyramid:

Sketch a food pyramid for your cetacean on the back of this paper.

Food Web:

Sketch a food web for your cetacean on the back of this paper.

Activity Sheet

Name _____ **Date** _____

Habitat:

Requirements_____

Threats_____

Ecology:

Other environmental components

_____

Human activities that affect health of zone residents

_____

Status

Population size_____
Federal status_____
State status_____

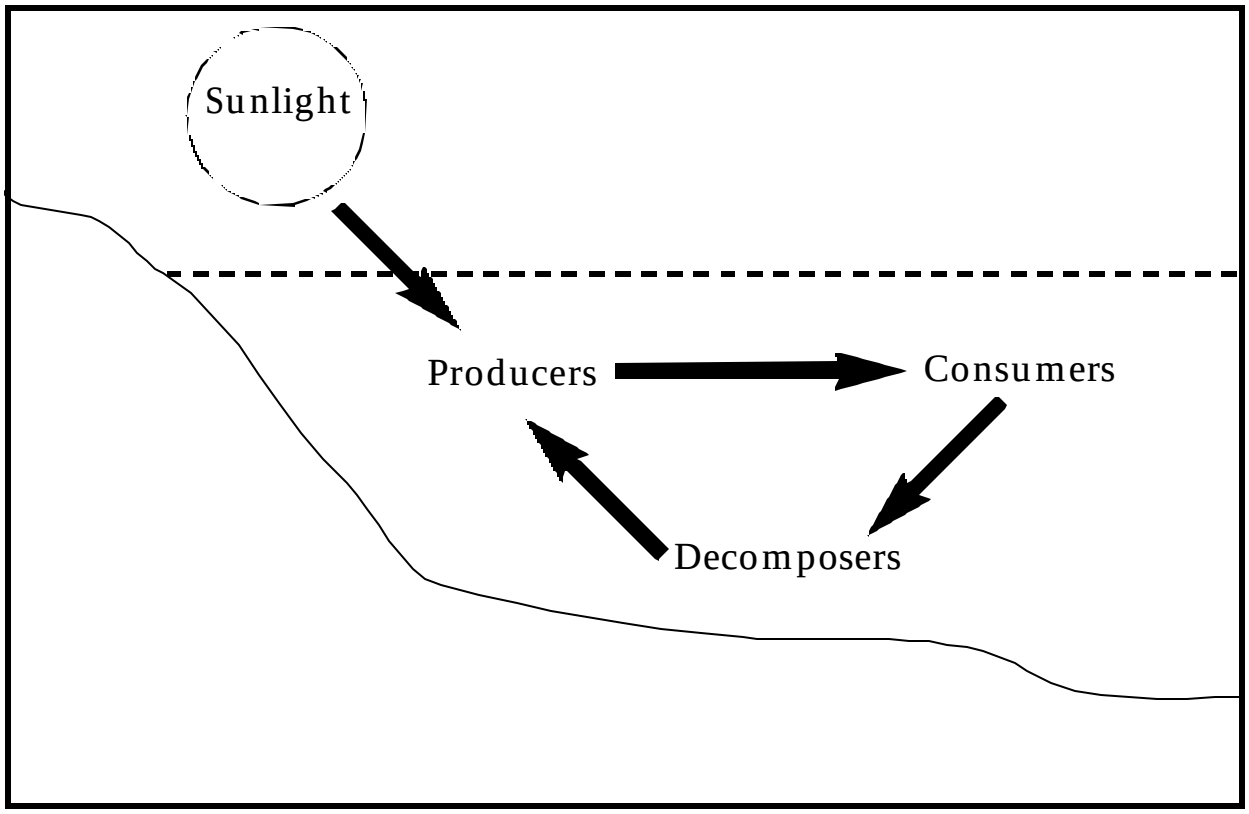
Summary:

What oceanic life zones can your whale be found in?

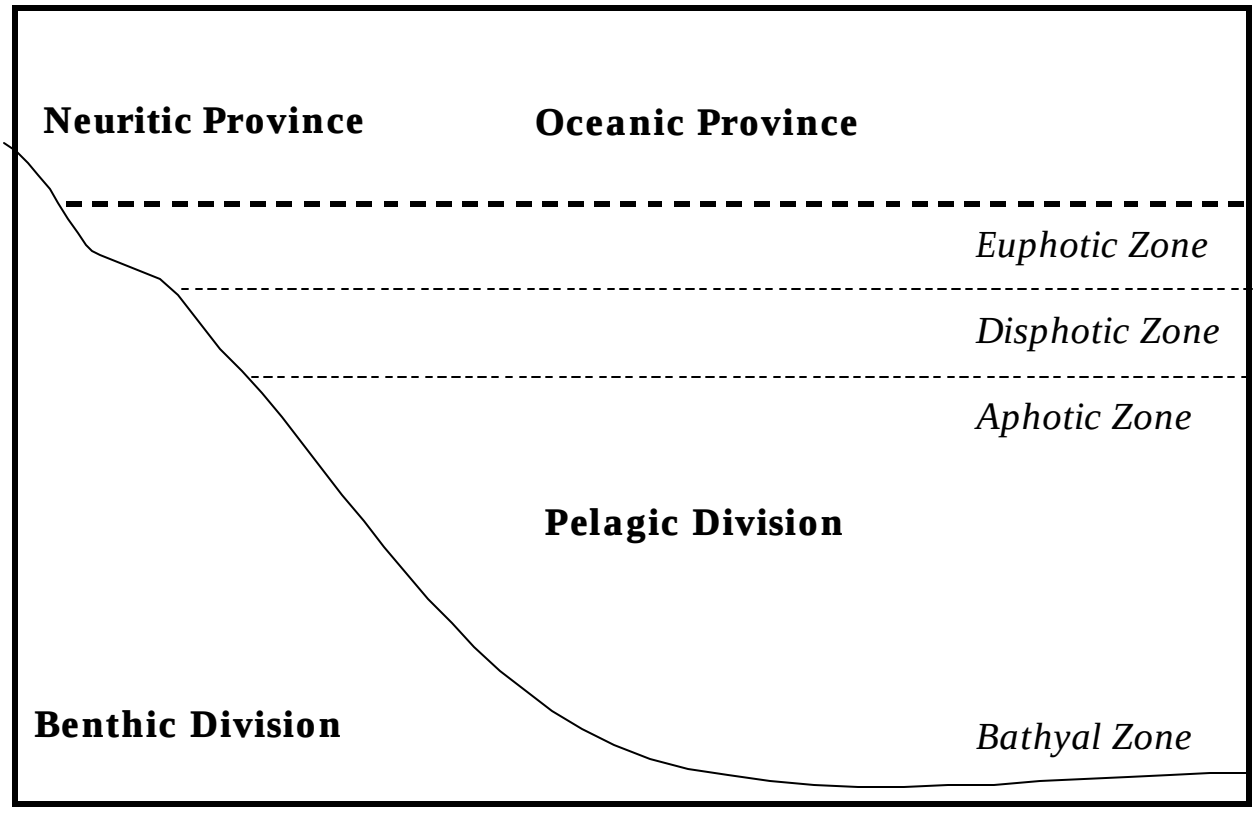
How would you define the niche of your particular whale?

Provide a drawing or photocopy illustrations of your whale and other organisms in its community.

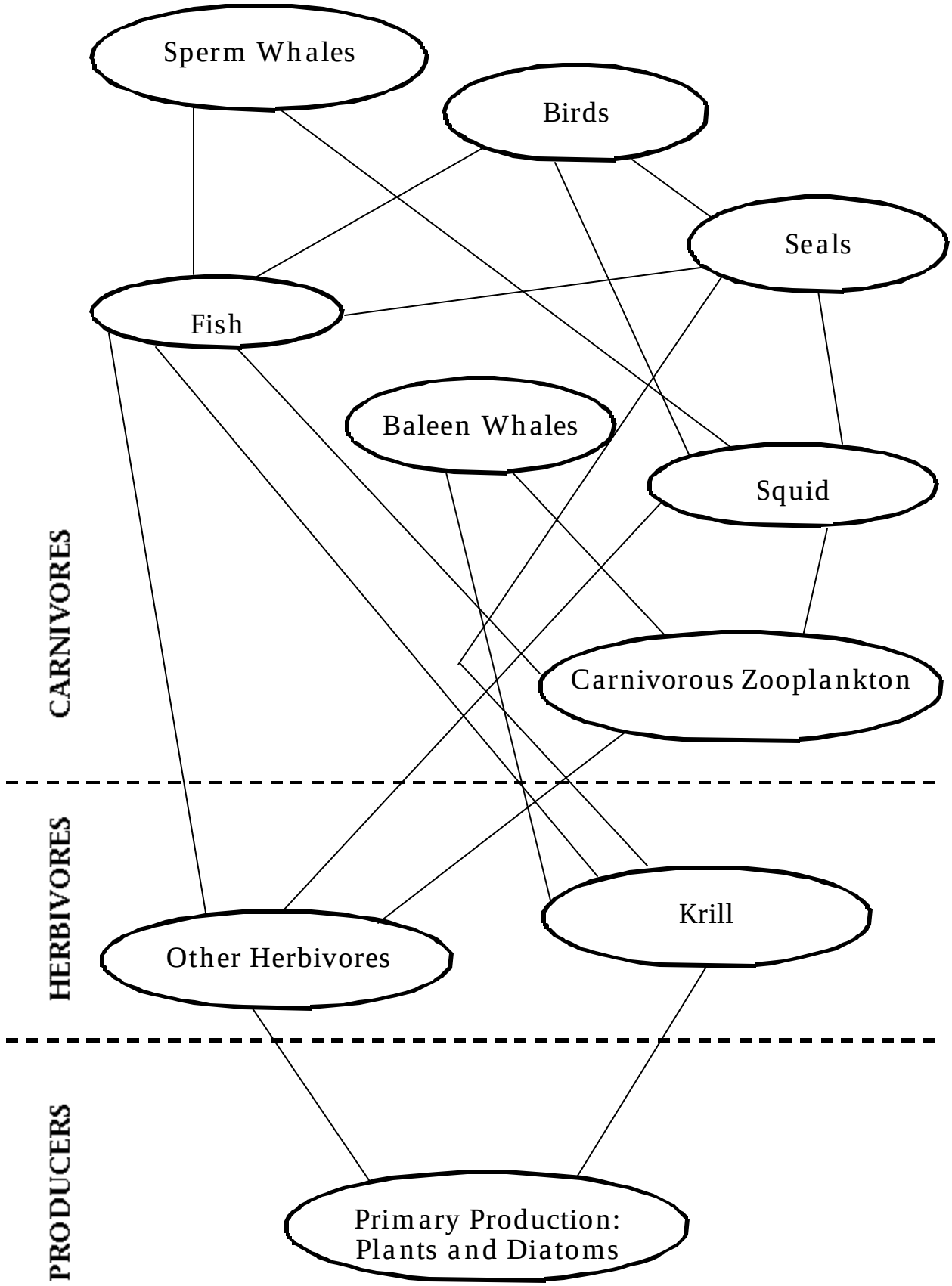
Oceanic Energy Cycling



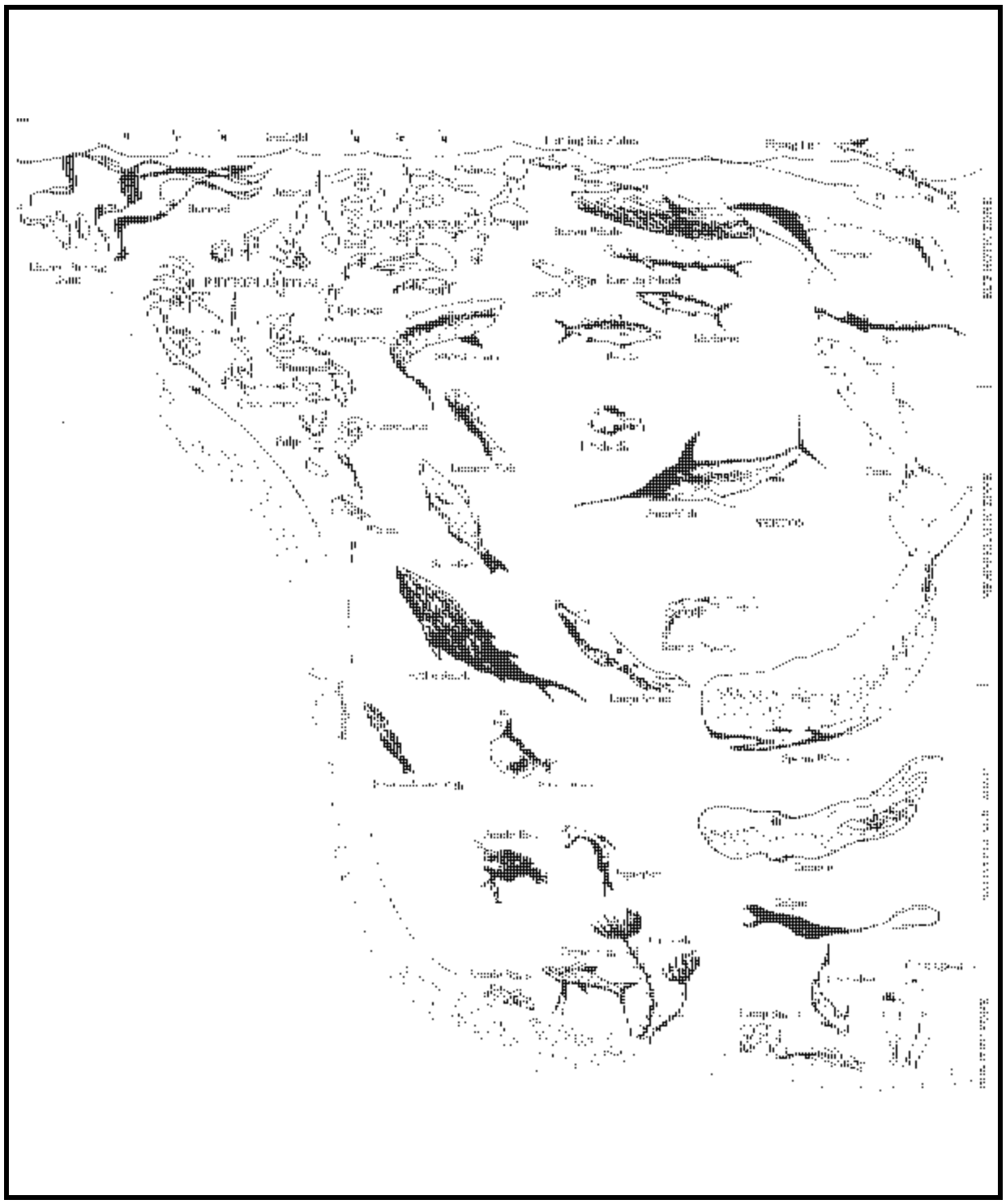
Major Oceanic Life Zones



Example of a Simplified Food Web for Pacific Ocean



Pacific Ocean Seascape



What Can We Expect on our Field Trip to Observe Gray Whales at Point Reyes National Seashore?

Students prepare for field activities while visiting Point Reyes National Seashore to observe gray whales. Journals are assembled and reviewed for content and expectations. It is imperative that students understand how to use their journals to get the most out of their field trip.

Time required: 1 hour

Location: classroom

Suggested group size: all

Subject(s): science, math, writing

Concept(s) covered: safety, gray whale behaviors, recording observations

Written by: Christie Denzel Anastasia, National Park Service

Last updated: 01/08/01

Student Outcomes

At the end of this activity, the students will be able to:

- Understand how to use their journal as a tool in field observations.

California Science Standards Links (grades 6-8)
This activity is linked to the California Science Standards in the following areas:

6th grade 7b- appropriate tools and technology to perform tests, collect and display data.

7th grade 7a- appropriate tools and technology to perform tests, collect and display data.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A- Use appropriate tools and techniques to gather, analyze, and interpret data; understanding about scientific inquiry.

- Content Standard G- Science as human endeavor; Nature of Science: students formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.
- Content Standard F- Populations, resources, and environments

Materials

To be provided by the teacher:

- blank paper to be included in field journals

To be photocopied from this guide:

- **Field Journal Sheets** for each student(located in first onsite lesson plan)
- **Field Journal Master** for each teacher and chaperone
- **How Can I Capture My Experience in a Story, Poem, or Drawing?** Field Journal Sheet (second onsite lesson plan)

Vocabulary

baleen, invertebrates, krill, pods, sounding, spouting, spy-hopping, upwelling

Procedures

1. Create journals

Have students construct their field journals. See **Tips for Creating Field Journals**, following this lesson plan page. Distribute photocopies of the Field Journal Sheets and have students assemble their field journals.

2. Review field trip logistics

There are two primary activities included in this field visit: whale watching and a scavenger hunt. Ideally, students arrive at the Lighthouse Parking Lot, use restrooms, and walk toward the Lighthouse Visitor Center and Observation Deck (15-minute walk). Students will then be assigned to teams with a chaperone. Ideally five students per chaperone. All activities take place in a relatively close distance and allow for flexibility. Half of the teams will work on the Scavenger Hunt while the other half will whale watch. After a pre-determined amount of time, the teams will switch activities.

3. Review journal structure and expectations

Review field activities by having students turn to appropriate page in their journal as you review expectations. Students may also record their name and school name at top of each journal sheet.

• Things to Remember While on Field Trip
This journal sheet will be completed as a result of the next activity, "Safety and Stewardship Challenge".

• Gray Whale Field Guide
This page should be carefully reviewed in class prior to the field trip so students know what to expect to see. These behaviors will also be used in recording observations on **Whale Sighting Log**.

• Whale Sighting Log/Other Marine Species Sightings
Students will give their whale sighting an identification number, record behavior, and any other additional notes. They will also use the identification number to record approximate location on **Whale Sighting Map**.

• Whale Sighting Map
With the Lighthouse as a landmark, students will use their unique identification number for a specific whale to record approximate location of sighting. Some identification numbers will appear more than once if a dive sequence is visually followed. Direction of travel for whales will also be recorded.

• Scavenger Hunt Sheets A-J
Student teams will work on these activity sheets together. This "hunt" takes place in the Lighthouse Visitor Center and on the Observation Deck. All of the information needed to fill out the worksheets is located on displays or can be based on prior knowledge. All of the text for these displays is included after the first onsite lesson plan, **Exhibit Panels at Point Reyes Lighthouse Visitor Center for Scavenger Hunt**.

4. Review chart for gray whale sightings at Point Reyes
Use the chart on **Scavenger Hunt** sheet "G" to see where your visit will fall within the gray whale sightings for Point Reyes National Seashore.

5. Review "How to Whale Watch"
There may be a Park Ranger on the observation deck for your field trip. This ranger can give your class a demonstration on whale watching. Prepare your students by reviewing the information below.

- Scan the entire ocean surface for spouts without using your binoculars.
- Observe the surface from shoreline to horizon.
- Spouts will look like a "puff of smoke".
- Sometimes when it is windy, students will see whitecaps and think they are whales.

- If a whale has truly surfaced and spouted, you should be able to see a whale "footprint". "Footprints" are formed when the whale comes to the surface and dives below again. The area where the whale was located is glassy, smooth, and oval shaped.

- Focus your binoculars on where you saw a spout or a footprint. You should be able to locate where the whale will resurface next.

6. Review list of what students should bring on field visit

. See Teacher Preparation / Field Logistics

Tips for Creating Field Journals

Materials

- ☐ Field Journal Sheets for each student, teacher, and chaperone
- ☐ One package blank paper and one package lined paper
- ☐ Colored paper, card stock, or cardboard for journal covers
- ☐ Magic markers or colored pencils for decorating covers
- ☐ 3-hole punch
- ☐ String, binding tape or twigs and rubber bands for binding
- ☐ Pencil on a string for each student
- ☐ Two plastic pencil sharpeners and extra pencils for field trip
- ☐ One box of large ziplock bags to rainproof journals

Procedures

1. Photocopy all of the unit handouts and provide each student with double-sided copies. Use recycled paper if it is available.
2. Provide five additional blank sheets of paper and five lined sheets of paper to each student.
3. Have students create front and back covers for their journals using blank sheets of paper.
4. Have students bind their journals using binding tape, hole punches and string, cardboard, or a twig bound by rubber bands threaded through holes.
5. Once journals are bound, have students decorate the covers.
6. Have each student attach a sharpened pencil on a long string through a hole in the journal binding.
7. Have each student use a magic marker to write their name on the front cover of their journal.
8. Students will need a sturdy writing surface behind their field journals. Incorporate cardboard as the last page or have clipboards available for each student.

Extension ideas

1. Create a journal that is used throughout the year.
2. Share student journals with parents at open houses.
3. Students may choose to use their journals to create a class newsletter, resource newspaper, or a class website.

Safety and Stewardship Challenge

Students will learn methods for observing gray whales and understand proper behaviors in a National Park. This will be accomplished by simulating a group "game show" and completing the first page of their field journals.

Time required: one hour

Location: classroom

Suggested group size: any

Subject(s): science

Concept(s) covered: low impact use of natural areas, behaviors in a National Park, safety

Written by: Christie Denzel Anastasia and Lynne Dominy, National Park Service

Last updated: 06/20/00

Student Outcomes

At the end of this activity, the students will be able to:

- List three safety precautions for upcoming field trip.
- List three proper behaviors for viewing gray whales.
- Understand concepts of National Park System and stewardship.

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard F -Personal Health: Injury Prevention; Populations, resources, and environment.

Materials

To be provided by the teacher:

- Desk bell (or other device to indicate which team has the first answer)

To be photocopied from this guide:

- **Safety and Stewardship Challenge Questions** Teacher Information Sheet (one set)

Vocabulary

stewardship

Procedures

1. Divide class into teams.

Option A: If class can work as large teams, divide the class into two teams. Each team will need a spokesperson and team name. Answers will come from the entire group. Spokesperson can change throughout the game.

Option B: If class may get too loud, students can still be divided into teams, but answers will come from individuals on each team. One person from each team will be assigned a number. Team A and Team B will each have a #1, #2, etc. Randomly choose a number from hat. The student with that specific number from each team will be responsible for answering the question. Random choice of numbers will help students pay attention if they aren't quite sure when their turn will occur.

2. Draw Challenge Grid and Scorecard on blackboard.

There are four categories with questions of varying value. As a finale, there is a final jeopardy question. Draw this grid on the chalkboard:

<table>
<tr><td colspan="4">Safety and Stewardship Challenge</td></tr>
<tr><td>Category #1
Take Care of Yourself</td><td>Category #2
Minimize Your Impact</td><td>Category #3
Whale Etiquette</td><td>Category #4
The National Park Service</td></tr>
<tr><td>1 point</td><td>1 point</td><td>1 point</td><td>1 point</td></tr>
<tr><td>2 points</td><td rowspan="2">2 points</td><td>2 points</td><td rowspan="2">2 points</td></tr>
<tr><td>3 points</td><td>3 points</td></tr>
<tr><td rowspan="2">4 points</td><td rowspan="2">3 points</td><td>4 points</td><td rowspan="2">3 groups</td></tr>
<tr><td>5 points</td></tr>
<tr><td colspan="4">Final Challenge</td></tr>
</table>

3. Choose Game Show Hosts

Option A: Teacher is responsible for asking all of the questions.

Option B: Four students will become "Challenge Hosts". Each student receives questions for a specific category and will ask appropriate questions according to point value.

4. Rules of the Game

- A coin flip will determine which team goes first.
- The game will end when a predetermined time runs out or when all questions have been answered.
- Team will decide which category and value of question will be asked.
- Spokespersons or individuals will poise themselves on either side of the desk bell with one hand behind their backs.
- After the question is asked, the first team to have an answer will ring the bell and respond. If they are correct, the team receives the full point value.
- If they are incorrect, the other team gets a chance. If they also get it wrong, the first team can try again for one less point.
- When brainstorming answers, students should whisper, or the other team may hear their answer.
- When all of the categories are complete (or 5 minutes before a predetermined "game-over" time), class will go into "Final Jeopardy". Each team decides on amount of wager, listens to question, and writes down answer on a sheet of paper. Each team reveals answer.
- At the end of the game, the team with the most points "wins", but everyone wins if your visit to Point Reyes National Seashore will be safe for themselves and the resources.

5. Complete first page of field journal.

Using the information gained in this "game show", have students list at least three items under each category on the first page of their journal (**Things to Remember While on Field Trip**). Use the **Safety Issues: Whale Unit** Teacher Information Sheet at the end of this lesson as a guide.

Safety and Stewardship Challenge Questions

CATEGORY #1: Take Care of Yourself

1 point

Bring a water bottle and drink plenty of water because…

A …you will not be able to speak well with a dry throat.

B …not drinking enough water can give you a headache and cause you to make bad decisions.

C …a heavy water bottle will slow you down as you are walking.

D all of the above

2 points

If the sun feels warm, you should…

A …try to get a tan.

B …use sunglasses, sunscreen, and/or a hat.

C …take off your shoes and walk barefoot.

D all of the above

3 points

Cliff edges in Point Reyes National Seashore are…

A …made of granite and safe as long as you have one foot flat on the ground at all times.

B …sandy, loose, and slipper;, be careful at all times.

C …safe if you have good balance.

D …the best places for a good view.

4 points

The best way to dress for a field trip:

A Comfortable, close-toed shoes.

B A T-shirt and a heavy, waterproof jacket.

C "Like an onion", many thin layers with a waterproof one on the outside.

D A and C

Safety and Stewardship Challenge Questions

CATEGORY #2: Minimize Your Impact

1 point

When visiting Point Reyes National Seashore, you should stay on trails because…

A …you are more likely to pick up a tick in grassy areas.
B …when you travel off-trail you can damage plants.
C …you are speeding up erosion.
D all of the above

2 points

It's okay to take home just one rock from Point Reyes National Seashore ...

A Sure, it's just one, but let your teacher know.
B No, every rock is home to many bugs and plants.
C No, with 2.5 million visitors, the Seashore would be rock-less if every visitor collected just one.
D B and C

3 points

Trash is….

A …okay to hide behind bushes in a National Park because it will eventually break down.
B …not a good source of food for hungry animals.
C ...not a part of the Point Reyes National Seashore ecosystem and should be properly disposed of whether it's your trash, or trash that someone else accidentally left behind.
D …only the responsibility of the maintenance staff, wherever it is.

Safety and Stewardship Challenge Questions

CATEGORY #3: Whale Etiquette

1 point

If a gray whale has spent too much time diving, you should…

A …give up.
B …pay attention and wait until it resurfaces.
C …throw some of your lunch into the ocean.
D …stop looking for whales because you have lost patience.

2 points

Stay at least…

A 1 foot from a marine mammal.
B 10 feet from a marine mammal.
C 100 feet from a marine mammal.
D Get as close as you want.

3 points

The best way to observe gray whales is to:

A Have patience.
B Look for spouts or blows below the horizon.
C Pay attention
D all of the above

4 points

Feeding wildlife will…

A …be okay, because it is legal.
B …put you in danger from a bite or an attack.
C …accustom them to humans and possibly create behaviors harmful to the animal's survival.
D B and C

5 points

If you come across wildlife appearing sick or injured, you should:

A Try to capture the animal and seek medical attention.
B Report the location, species, and your observations to someone who is responsible for its management (Park Rangers in National Parks, Humane Society in urban areas).
C Leave it alone.
D Get as close as possible to observe what is happening.

Safety and Stewardship Challenge Questions

CATEGORY #4: The National Park Service

1 point

Which of the following is not a part of the National Park System?

A Grand Canyon National Park, AZ
B Point Reyes National Seashore, CA
C Monterey Bay Aquarium, CA
D Golden Gate National Recreation Area, CA
E Yosemite National Park, CA

2 points

I should treat Point Reyes National Seashore with respect because…

A …it belongs to everyone in the entire United States.
B …it preserves a part of the ecosystem you live in and depend on.
C …it's one of the few places natural processes can happen with little intervention from human society.
D all of the above

3 points

Which of` the following is the mission of the National Park Service?

A Preserve natural and cultural resources.
B Provide for the enjoyment, education, and inspiration of this generation.
C To care for special places saved by the American people so that all may experience our heritage.
D Cooperate with other resource-conservation and outdoor-recreation organizations in our country and the world.
E all of the above.

Bonus for one additional point:

Is the Mission of the National Park Service a law?

Yes. The 1916 Organic Act mandates the National Park Service to preserve and protect the natural and cultural heritage of the United States for the enjoyment of its citizens, leaving them unimpaired for the enjoyment of future generations.

FINAL CHALLENGE

This question is worth the amount that each team agrees to wager.

What does stewardship mean?

Teacher is the final judge on this answer.

Safety Issues: Whale Unit

Personal Safety

- Watch where you are walking, the ground may be rocky and uneven.
- Stay with your group.
- Drink plenty of water to avoid dehydration.
- Protect yourself from the sun's rays, use sunscreen and/or a hat.
- Stay on paths and in picnic area. Grassy areas may have ticks known to transmit Lyme's Disease.
- Be aware of personal allergies or conditions that may cause concern on the trail.

Remember... You are in a part of the National Park System.

- Point Reyes National Seashore is a natural area set aside to protect living and nonliving components of an ecosystem. Treat everything with respect.
- Allow plants and rocks and everything to continue their existence as part of an ecosystem by leaving things as they are found.
- Stay on established trails.
- Pack out trash or use garbage cans.
- Enjoy your visit, this is your National Seashore!

How Do I Use Binoculars?

Students prepare for upcoming Pacific gray whale field trip by becoming familiar with binocular structure and use. The key to whale watching is being able to locate the whales first without binoculars, and then to quickly relocate the whale again with binoculars.

Time required: time varies

Location: in class and/or sections at Bear Valley Visitor Center

Suggested group size: entire class

Subject(s): physics

Concept(s) covered: binocular structure and use

Written by: Christie Denzel Anastasia, National Park Service

Last updated: 09/31/00

Student Outcomes

At the end of this activity, the students will be able to:

- Understand the structure of binoculars.
- Practice focusing on moving images with binoculars.

California Science Standard Links (grades 6-8)

This activity is linked to the California Science Standards in the following areas:

6th grade	7b-appropriate tools/technology to perform tests, collect/display data
7th grade	6b-to see an object, light emitted/scattered must enter eyes 6d-simple lenses used in optics 7a-appropriate tools/technology to perform tests, collect/display data

National Science Standard Links (grades 5-8)

This activity is linked to the National Science Standards in the following areas:

- Content Standard A - Abilities necessary to do scientific inquiry: use appropriate tools and techniques to gather, analyze, and interpret data.

Pre-Visit Lesson Plan

Materials

To be provided by the teacher:

- Pacific Gray Whale Kit and 20-40 pairs of binoculars (available for checkout at Bear Valley Visitor Center)

Procedures

Note: This lesson can be done in various stages depending on whether or not students have access to binoculars in class.

If students can ***bring in a pair*** of binoculars to use in class:

this entire lesson can be conducted in class.

If students can ***share a pair*** of binoculars to use in class:

Procedures 1 and 2 can be taught to entire class. Student teams can experiment with binoculars in 10-minute intervals throughout day.

If students ***do not have access*** to binoculars:

Procedures 1 and 2 can be conducted in class, Procedure 3 at Bear Valley Visitor Center when students receive individual binoculars from the Pacific Gray Whale Kit..

1. How do binoculars work?

In Theory: Before prisms were available, lens barrels had to be very long to increase the distance between eyepiece lens and objective lens to achieve magnification. These are the traditional "piratescopes". With the introduction of prisms, the light was bent and barrels made shorter. Binocular vision allows two images to become one for depth perception. Monoculars are like binoculars, but made for one eye and provide no depth perception.

In Structure: There are four main components of binoculars. Power is a function of these components. A 6x30 binocular has 6x magnification and a 30-millimeter lens. A larger lens lets in more light.

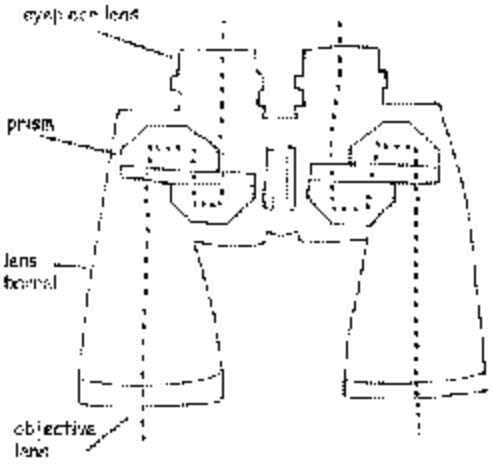
Eyepiece Lens: There are several convex lenses here for magnification. This is the lens closest to your eyes.

Prism: Bends light rays and returns reverse image to normal.

Lens Barrel: Keeps distance between eyepiece lens and objective lens. Blocks side lighting and protects from dirt.

Objective Lens: Gathers light in a convex lens. This is the lens that has a millimeter measurement (i.e., 6x30).

Diagram of Binocular Design



2. How do I get binoculars to work specifically for me?

Taking care of binoculars:

- Always keep them attached around your neck so they aren't accidentally dropped.
- While you are focusing binoculars, stand still. It would be easy to fall while focusing and walking.
- Clean binoculars properly.

If you wear eyeglasses:

- Keep your eyeglasses on.
- There is usually an "eye cup" rubber piece that folds back where your eyeglasses meet the eyepiece lens.

Things you adjust once:

- Barrel distance: The two barrels can be moved closer or further apart depending on the distance between your eyes.
- Focus right eyepiece: There is a knob on the right eyepiece that corrects for visual differences between your two eyes. If you are seeing more than one image, adjust the right eyepiece until there is one image.

Things you need to adjust with each observation:

- Center focus: Adjust the center focus with each observation to bring image into view.

Focusing on an image:

- Adjust barrel distance and right eyepiece
- Locate the image with your eyes. Are there any landmarks or reference points next to the image? These may help you find the image using the binoculars.
- Focus your eyes on the image. Without looking down, place the binoculars directly in front of your eyes. The rubber cup surrounding the eyepiece lens should rest against your eyebrow (unless you are wearing eyeglasses).
- Focus image into view with center focus.Keep elbows tucked in close to your body and both hands on binoculars to avoid a shaky image.

3. Practice using binoculars

Focus on a stationary object.

- Pick an object that doesn't move. Choose one somewhat near and one somewhat far. Use center focus.

Focus on moving objects in class.

- Right/left: Have a student walk slowly across the classroom while students use binoculars to keep in view. Speed up student walker to add a challenge.
- Away/toward: Choose a student to move toward and away from binoculars. Discuss range at which binoculars will work. At some point, object is too close to focus.

Focus on multiple moving objects at school.

- Attend a sporting event or practice at a lunch session in the cafeteria.
- Place a wildlife poster on a piece of cardboard and stick. Have a student move around the classroom with the posterboard: slow, fast, up, down, toward, away.

Focus on wildlife.

- Bring class outside in an area where they are likely to view moving wildlife such as birds.